Claims

What is claimed is:

1. An optical spectrum analyzer for analyzing at least n wavelengths of light comprising:

a tunable filter having an input port and an output port and a periodic output response with a free spectral range F_{SR} and having a bandwidth B;

an AWG optically coupled to receive light from the output port; and for distributing the light spatially at other locations in a wavelength dependent manner, and,

a plurality of m detectors optically coupled with the AWG for detecting wavelength or channel information, wherein $m<n$ when a single detector is associated with a single wavelength and wherein $m<2n$ when two detectors are associated with a single wavelength.

2. An optical spectrum analyzer as defined in claim 1, wherein the bandwidth of each output of the AWG is less than F_{SR}.

3. An optical spectrum analyzer as defined in claim 2, wherein the tunable filter has a wavelength range $R>F_{SR}$ and wherein the plurality of detectors m is at least R/F_{SR}, and wherein $R/F_{SR} < R/B$.

4. An optical spectrum analyzer as defined in claim 1, wherein the tunable filter is a resonator for receiving an input optical signal and for providing an output optical signal having an output response that is periodic in intensity with respect to wavelength such that an input light signal comprising a plurality of multiplexed channels is output such that a first group of spaced channels is substantially attenuated while simultaneously a second group of spaced channels are substantially un-attenuated, said second group of channels being periodically spaced in wavelength.

5. An optical spectrum analyzer as defined in claim 4, wherein the resonator is a ring resonator.

6. An optical spectrum analyzer as defined in claim 4, wherein the resonator and the AWG are disposed within a planar substrate.

7. An optical spectrum analyzer as defined in claim 4, wherein the resonator and the AWG are disposed within a same planar substrate.

8. An optical spectrum analyzer as defined in claim 4, wherein the resonator is tunable by varying a temperature about the resonator.

9. An optical spectrum analyzer as defined in claim 8, further comprising a controllable heater thermally coupled with the resonator.

10. An optical spectrum analyzer as defined in claim 4, wherein the plurality of detectors m are for detecting the light within the second group of periodically spaced channels; and wherein the m detectors are positioned to detect at least n output signals having centre wavelengths at n distinct locations, wherein n>m.

11. An optical spectrum analyzer as defined in claim 1, wherein the tunable filter is responsive to a controller for demultiplexing a multiplexed input signal into separate channels in such a manner as to provide at different instants in time, pluralities of groups of different channels spaced in wavelength to said plurality of detectors simultaneously, such that a first group of spaced channels are provided to said plurality of detectors at a time t1, and a second group of different channels having a substantially same wavelength spacing are detected at a time t2, where t1 is not equal to t2.

12. An optical spectrum analyzer comprising:

a resonator for receiving an input optical signal and for providing an output optical signal having an output response that is substantially periodic in intensity with

respect to wavelength such that light within a first group of spaced channels is substantially attenuated while simultaneously a second group of spaced channels are substantially un-attenuated, said second group of channels being substantially periodically spaced in wavelength;

an array of m detectors, for detecting the light within the second group of periodically spaced channels; and,

an arrayed waveguide grating having an input port for receiving the output signal from the resonator and having at least m/2 output ports to provide m/2 output signals to at least n distinct locations, light provided to the m/2 distinct locations being optically coupled with the m detectors.

13. An optical spectrum analyzer as defined in claim 12, wherein the resonator is tunable to control a free-spectral range of the resonator in a controllable manner for attenuating at least the second group of channels and for ensuring that first group of channels are substantially un-attenuated.

14. An optical spectrum analyzer as defined in claim 13, wherein the resonator is a ring resonator.

15. An optical spectrum analyzer as defined in claim 12, wherein a plurality of the m/2 distinct locations are optically coupled with a single detector such that the single detector is capable of detecting light from more than one channel at different times.

16. A method of providing wavelength information related to an optical signal having a plurality of channels of information encoded therein, wherein each channel has a center wavelength spaced from an adjacent channel, the method comprising the steps of:

a) launching a multiplexed optical signal including the plurality of channels of information into a tunable periodic filter to yield a periodic signal wherein a first group of the channels are discernable from others;

b) receiving the periodic signal and spatially demultiplexing the first group of channels;

c) detecting with an array of spatially separated detectors information related to the first group of channels;

d) tuning the tunable filter to yield a second periodic signal, wherein a second group of channels is discernable from the first group;

e) receiving the second periodic signal and spatially demultiplexing the second group of channels; and,

f) detecting with the array of detectors information related to the second group of channels, wherein same detectors used in step (c) are used in step (f) for detecting.

17. A method as defined in claim 16 wherein the tunable periodic filter is a resonator filter and wherein the steps of spatially demultiplexing include providing said periodic signals to an AWG.

18. An optical spectral analyzer as defined in claim 3 wherein the tunable filter is a ring resonator formed on a planar substrate.

19. An optical spectral analyzer as defined in claim 18 wherein the tunable filter is a ring resonator formed on a planar substrate wherein the input port on the tunable filter and the detectors are at a same end of a planar waveguide.

20. An optical spectrum analyzer as defined in claim 1, further comprising a polarization beam splitter for splitting output signals into linearly orthogonally polarized beams when two detectors are associated with a single wavelength.